

TYPHOON AMBER 18W

I. HIGHLIGHTS

Typhoon Amber (18W) was the second of four tropical cyclones which would develop within the monsoon trough during an eight day period. The system would later interact with Tropical Storm (TS) Cass (20W) then move across the island of Taiwan and the Formosa Strait and into China.

II. TRACK AND INTENSITY

By the 20th of August, the monsoon trough extended from southeastern Asia into the South China Sea, eastward through the Luzon strait, across the southern Mariana Islands and east-northeastward to Wake Island (where Typhoon Yule was approaching from the south-southwest). The monsoon trough was very active. Four different tropical cyclones would form during the next eight days: Typhoon Zita (17W) and TS Cass (20W), which formed in the South China Sea; Super Typhoon Bing (19W) which developed east of the Mariana Islands; and finally Typhoon Amber (18W) which began in the Philippine Sea. The pre-

Amber (18W) disturbance developed in a region of upper-level divergence overlying the surface trough. It was first mentioned on the Significant Tropical Weather Advisory (ABPW) on 20

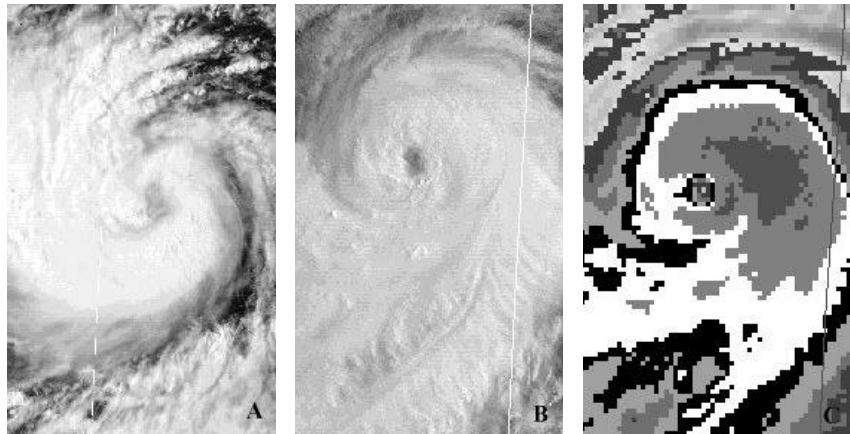


Figure 3-18-1 Typhoon Amber as seen by visible and infrared satellite imagery over a 36 hour period beginning 26 August at 0633Z. The valid times of the images are: far left 260633Z; middle and far right 242224Z. Note the banding type eye feature in the image at far left has developed into a more circular eye feature (better defined in the infrared imagery).

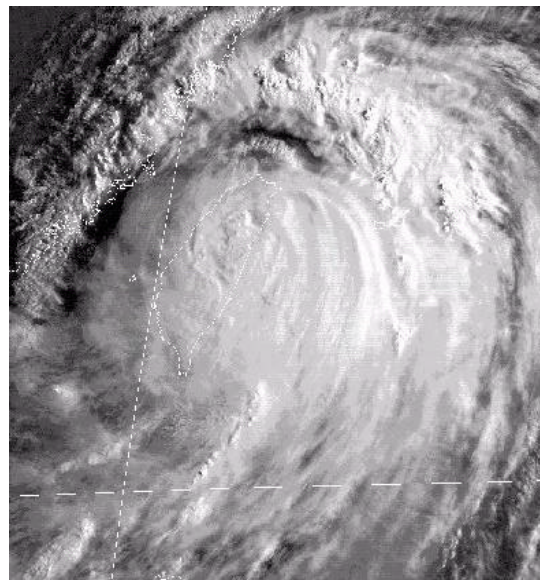


Figure 3-18-2 Visible imagery valid at 282227Z.

August. A scatterometer pass at 1340Z indicated at least 20 to 25 kt (10 to 13 m/s) of sustained wind. A Tropical Cyclone Formation Alert (TCFA) was issued at 0300Z on 21 August followed by a warning at 0600Z, prompted by a ship report of 40 kt (20 m/s).

Amber remained in deep monsoonal flow with the subtropical ridge to the north and ridging associated with Typhoon Zita (17W) to the west-southwest. This ridging allowed only a slow west-northwest motion ranging from 3 to 5 kt (6 to 9 km/hr), lower than what is normally associated with a tropical cyclone south of the sub-tropical ridge. This motion continued until 26 August when Tropical Storm Cass (20W) formed west-southwest of Typhoon Amber, close enough for direct interaction to occur. By 28 August, the effect of Tropical Storm Cass' circulation was to cause Amber's forward speed to increase to near 8 to 10 kt (15 - 19 km/hr) with a more northwestward motion. This motion continued as Amber moved across Taiwan and then China on 29 August.

Typhoon Amber (18W) intensified at a slightly faster than the climatological (one Dvorak 'T' number per day) rate. On 23 August at 0633Z, the intensity was estimated at 70 kt (35 m/s), based on visible satellite imagery which showed the development of a banding type eye. This eye became better defined in visible and infrared imagery on 24 August at 2246Z, when the intensity was 100 kt (50 m/s) (see figure 1). The system subsequently weakened to 85 kt (43 m/s) for a short time, but re-intensified to 110 kt (55 m/s) by the morning of 28 August as it began to approach Taiwan. Reports from the island indicated northeast winds of 75 kt (38 m/s) and a surface pressure of 992 mb at 0300Z 28 August; 6 hours later the pressure had dropped to 984 mb with north winds of 45 kt (23 m/s). By the morning of 29 August, Typhoon Amber began to move across Taiwan with an intensity of 95 kt (figure 3-18-2) maintaining typhoon intensity as it crossed the island's central mountains, some of which range from 8500 to 13000 feet (2600 to 4000 m). Land interaction weakened Typhoon Amber as it crossed into the Formosa Strait with an intensity of 80 kt (40 m/s). The system subsequently made landfall in China with an intensity of 65 kt (33 m/s).

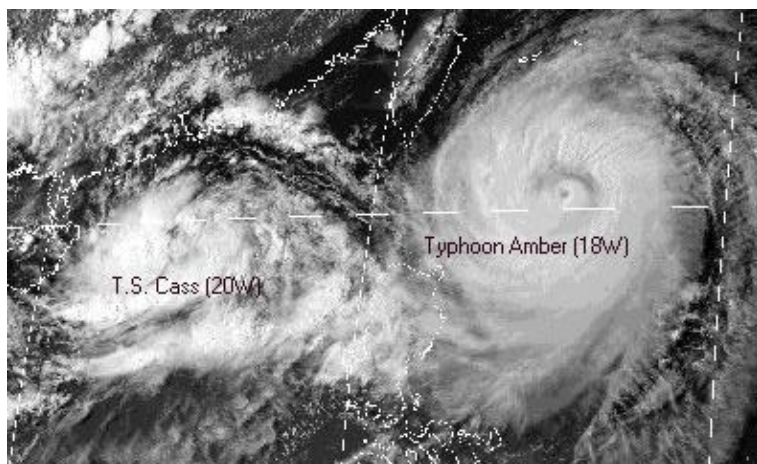


Figure 3-18-3 Visible satellite image (valid time, 27 August 0733Z) of Tropical Storm Cass and Typhoon Amber over the South China and Philippine Seas.

III. DISCUSSION

a) The formation of concentric eyes during intensification

Satellite imagery over a 48-hour period beginning from 25 through 27 August indicated that Typhoon Amber developed concentric eyes, a feature typically found only in intense tropical cyclones. The process starts when banding begins to wrap around the established central convective feature. An outer eye wall begins to form and dominates the inflow of moisture flowing towards the center, while

the inner eye wall begins to contract and may eventually dissipate. Refer to Figure 3-18-4. The image at top left shows a solid area of convection surrounding a cloud filled eye with a banding feature stretching from west to south of the center. The image at top right, which was taken about a day later, shows an area free of convection (known as the "moat" region) developing between the eyewall and the outer banding feature. The banding feature is closer to the eyewall and is wrapping around the center. The image at bottom left is 19 hours later and clearly shows a banding type structure. Microwave imagery 10 hours earlier indicated the presence of an eye; therefore cloud cover is probably obscuring it in this image. The image at bottom right shows fully developed concentric eyes with a moat in between. About 9 hours after the last image, Typhoon Amber reached a peak intensity of 110 kt (55 m/s). The concentric eye feature became less apparent in subsequent satellite imagery as Amber approached Taiwan.

b) Interaction With TS Cass, and Numerical Model Track Performance

While Typhoon Amber was transiting the Philippine Sea, TS Cass formed in the South China Sea approximately 700 nm (1300 km) to the west-southwest. The distance between these tropical cyclone, as shown in Figure 3-18-3, was close enough for direct interaction to occur (Carr and Elsberry, 1994). However, due to the smaller size and lesser organization of TS Cass, Typhoon Amber's track was only slightly more northwestward and faster than would otherwise be expected. The direct interaction was primarily one way as Typhoon Amber significantly altered the motion track of TS Cass. Although TS Cass had only a small effect on the actual motion of Typhoon Amber, it did complicate the forecasting process, because the models tended to exaggerate the extent of interaction Figures 3-18-5, 3-18-6 and 3-18-7 show the track reconstruction of Typhoon Amber along with the forecasted tracks from the NOGAPS, GFDN and FBAM models. Each model showed a poleward bias (as they normally do) early on, then switched to an equatorward bias as Typhoon Amber was just northeast of the island of Luzon.

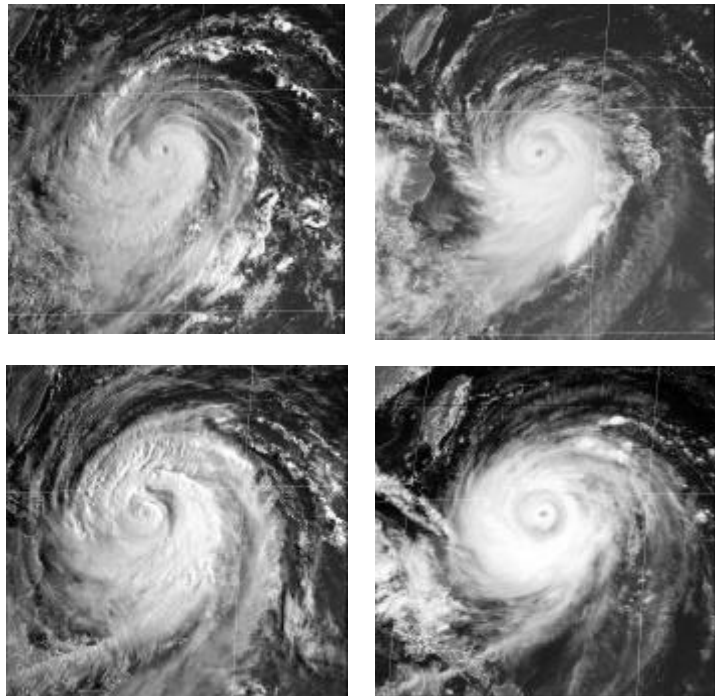


Figure 3-18-4 Development of concentric eye walls in Typhoon Amber during a 53 hour period beginning 242226Z August, as seen in visible satellite imagery. Valid times of satellite images are: top left, 242226Z; top right, 260334Z; bottom left, 262226Z; bottom right 270334Z. Peak intensity occurred shortly after concentric eye wall formation.

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IV. IMPACT

No reports were received by the JTWC on damage, injuries or fatalities due to Typhoon Amber.

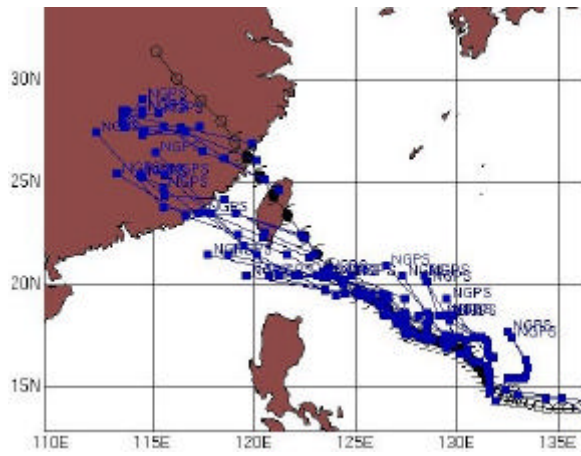


Figure 3-18-5 The best track and the NGPS forecast tracks for Amber (18W).

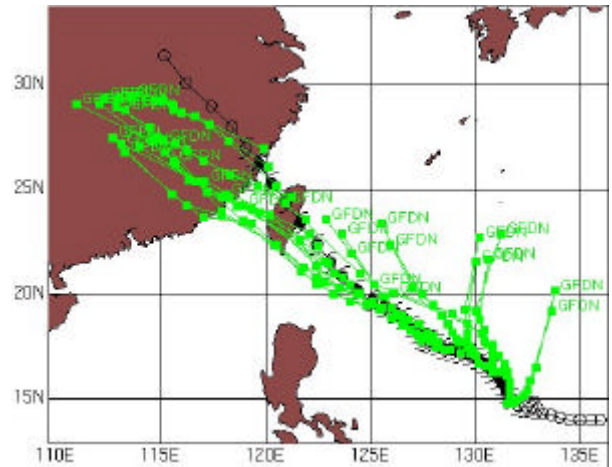


Figure 3-18-6 The best track and the GFDN forecast tracks for Amber (18W).

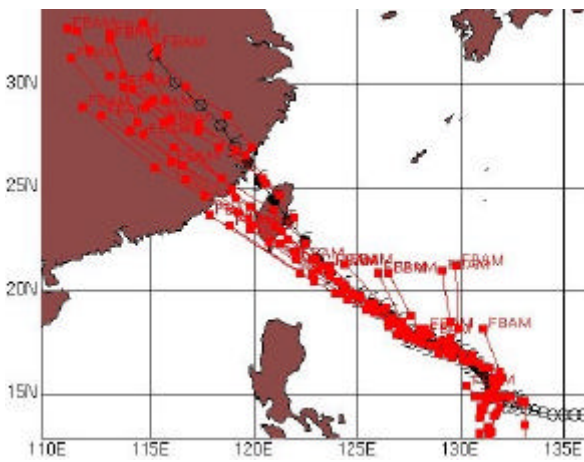


Figure 3-18-7 The best track and the FBAM forecast tracks for Amber (18W).

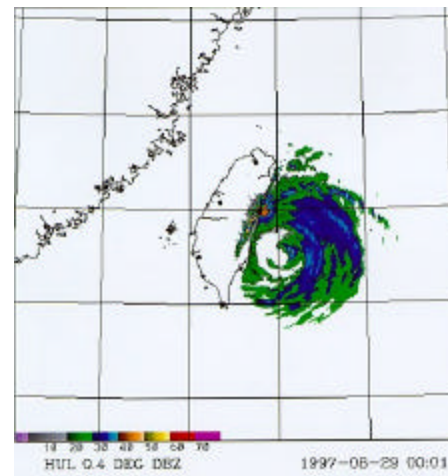


Figure 3-18-8 Radar image of Typhoon Amber as it is approaching Taiwan. Valid time is 290001Z

